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# SCIENCE

FRIDAY, APRIL 25, 1919

## RESEARCH AS A UNIVERSITY FUNCTION<sup>1</sup>

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SCIENTIFIC research implies independent and original thinking. It takes for granted that the person has made himself master of recognized facts in the domain where he proposes to extend the boundaries of knowledge, or will proceed to acquire the information. It also takes for granted that every conception is to be tested by material manipulation.

The modern university is derived by integration and adaptation from the learned teaching institutions of early times. As a consequence many medieval features still control the modern institution, often restricting its usefulness. The medieval universities were founded for monks and clerics, who instructed boys and young men in the accepted learning of the times. What they did in the way of adding to the store of knowledge or arranging it for better presentation was done in the quiet of the cloister without thought of reward. In the modern university the investigator may work because he finds pleasure in doing so, and without expectation of encouragement or pecuniary assistance, if he so chooses, but it is the medieval way and not consonant either with the requirements or

<sup>1</sup> The local chapter of the Society of the Sigma Xi in Purdue University, desirous of "encouraging original investigation in science, pure and applied," in accordance with the requirements of its constitution, discussed methods of procedure at a meeting in May, 1918. It concluded that the first thing to do was to make "a survey of the research work in Purdue." Accordingly a committee was appointed, which sent a questionnaire to every member of the instructional force of the university without regard to membership in the society. The report of the committee was presented at a meeting of the chapter January 21, 1919, and the following remarks were made by the president of the chapter as a part of the discussion which followed.

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ideals of the present. To extend the boundaries of knowledge as well as of political domains can no longer be done adequately by casual individual effort, as one plays golf, or goes duck hunting, or responds to the love of adventure. There are, however, administrative officers, in fact I am not sure but that the impression is quite general among other persons, who believe that the pleasure of achievement, especially if combined with the approbation of associates, should be considered ample reward for research, even the most prolonged, laborious and costly. The life of the ascetic, comparative poverty, and overwork are preached as the lot to be accepted by the man who delves for hidden lore. It is a musty notion which we as "companions in zealous research" need not countenance.

But the modern world only pays for things that are worth while, not for lore because it is curious or interesting, even when strictly scientific. We hear much at present regarding the value of science. It has been called upon to aid every department of action in the recent war. The very immensity, destructiveness and decision of the conflict rested upon marshaling the achievements of science. It was Germany that led the way, and the rest of the world has opened its eyes to the desirability of cultivating the acquaintance of this much neglected handmaid of national success. Do not forget, however, that Germany's progress in fostering and utilizing science has not been projected over very many years, indeed it has been entirely within the lifetime of the speaker, dating from Liebig's applications of chemistry to agriculture. Leadership is not to be left in German hands unchallenged, if any one may judge by such indications as the establishment in the United States of a National Research Council, in England of the Committee of the Privy Council for Scientific and Industrial Research, and of similar organizations in France, Italy and Japan.

But it would seem that the movement to exploit science more fully is directed chiefly to what may be called industrial or applied science, and what is designated pure science

must be content to be praised while begging for a crust. As to the distinction between pure and applied science and their relative importance in the welfare of a people I wish to present two illustrations.

I well remember the teaching of my college professor in undergraduate days, showing how organic compounds had such complex molecules, that it would be impossible ever to make them without the aid of the living organism. But eventually indigo was formed synthetically, a most wonderful achievement of pure science, the culmination of more than half a century of effort, and the independent work of hundreds of research chemists. Starting with this result the Badische Company spent seventeen years and five million dollars in industrial research before a pound of indigo could be put on the market.

The indigo of commerce to-day is a possibility realized through the unpaid labor of many men devoted to pure science extending over a long period, followed by the paid labor of fewer workers in industrial science during a much shorter period. It is not necessary to multiply examples to demonstrate what every one knows, that the products of pure science are the material with which applied science works, and that both are needed for advancing the wealth and convenience of the world. It would seem to be the part of wisdom to give equal and abundant encouragement to the workers in both classes of science.

Again I remember the published accounts of the repeated efforts of Professor Langley, of the Smithsonian Institution, to produce a heavier-than-air flying machine. It was difficult to secure funds and even more difficult to awaken intelligent interest. Finally a machine was constructed that flew several hundred feet, and then ignominiously fell into the mud of the Potomac. The daily press found no end of amusement in this episode, and Professor Langley was not able to secure further backing. He was greatly dispirited and mortified, and not long afterward died. Once more, when the Wright brothers of Ohio had so far developed their machine that its capacity for successful flight could no longer be

questioned, the government was unwilling to finance the perfecting of it, and the work had to be completed on the other side of the Atlantic. At the entry of this country into the World War flying machines were greatly needed, and six hundred millions of dollars were largely wasted in experiment before entering upon a course that led to success; a success, however, that placed the first efficient machines in the field just after the fighting was over.

It would seem that the wisdom of preparedness in scientific lines as in others has had a most vivid demonstration in many instances during the course of the Great War. How well it has been learned is yet to be shown in the increased amount of encouragement and support given to both pure and applied science in the days to come. We will see if some of the hundreds of millions of dollars, or possibly billions fortunately conserved by the curtailment of the war will be turned into productive science, or be used for another display of ineptitude.

Most of the members of this society have closer relations with the university, however, than with the government. The purpose of the questionnaire recently sent to the members of the instructional force of Purdue University was to ascertain the attitude of the various individuals toward research, what amount of such work was under way, and what encouragement was being received by them from any source.

The replies show clearly that research is probably favored by all, many are attempting it, and a few succeed. Some persons are not naturally endowed with the qualities that are required by the able investigator, as some do not make good teachers, good administrators, good inventors, etc. A few apparently do not know what sort of effort is required for research. One answers that he does no research because he has not been assigned to it, others say they have no chance to work out their problems. It is undoubtedly true, as I find stated in one of the answers, that "men who are waiting for 'chances' are usually

those who have given no objective sign of research ability."

As to the attitude of superiors it appears, except for a few cases, to be favorable, and in some instances most cordial. Part of the feeling that the man above does not support the effort to do original work can probably be ascribed to individual temperament. I find one answering that the attitude of his superior is 'indifferent,' yet the head of this department returns the following statement:

I feel that not only this university but all institutions of higher learning should encourage research work on the part of its teachers. Nothing should be left undone that could aid in bringing about a healthful activity along this line.

In a department that is not well suited to research one returns the statement that he does none because objection is made by the department, while another says he is engaged in research directed and paid for by the department.

Nevertheless, there seems to be a just and nearly general complaint, except from a few who are in the engineering or agricultural experiment stations, that they are so heavily loaded with routine work that little time or energy is left for research. This brings up the question if it be not a legitimate part of a university man's duty to devote some of his time and strength to extending the boundaries of knowledge, and should not this be recognized and provided for by the university which he serves. What are the functions of a university? The higher institutions of learning are now as they have always been, the source and the disseminators of learning. They have been charged with the two-fold duty of increasing the stock of knowledge and of teaching.

One of the questionnaires brought out this statement: "My ideal of a position is one where most of the time is given to research aided by several interested students, and part of the time taken up with preparing and delivering lectures in courses where one has the benefit of contact with interested students." By adjusting the ratio between teach-

ing and investigation to the subject and to the aptitude of the instructor this would indeed be a generally ideal arrangement, and one by no means beyond the reach of most universities, with due allowance for the "interested students." Every university owes it to itself and to its constituency to maintain a high standard for efficiency, and to attain this a due provision for the encouragement of original thinking and original endeavor is an important factor. The university also owes it to the nation, for a nation that can secure and maintain supremacy in the intellectual field by its contributions to knowledge, its handbooks and treatises, can profoundly influence the course of thought throughout the world, and commands one of the strong elements of national greatness. Mr. W. R. Whitney, of the General Electric Company, said about two years ago:

The part of research I am most interested in promoting is what we may call the unpaid kind, not because it is cheapest, but because it is most valuable. It is most neglected, most poorly understood, most in need of appreciative support in America. While I am greatly interested in what might be done for science by technical research laboratories in the industries, I am sure that the university must be the important factor in guiding the pioneer work if we are to be a sufficiently advancing nation.

If there be any grain of truth in what was returned upon one of the questionnaires that the university to which we belong, "as an institution [doubtless intending to except the two experiment stations], affords little encouragement and practically no opportunity for research," then this society should exert itself to help in bettering conditions. I am sure the society stands ready to cooperate with the authorities of the university in carrying out whatever program may be found advisable. The committee in its report has made excellent recommendations looking in this direction.

In a statement made last May by the Honorable Elihu Root before the Advisory Committee on Industrial Research of the National Research Council he emphasizes the need of encouragement to research and especially urges

a better organization among scientific workers, more cooperation, and a clearer sense of responsibility, closing with the words, "the prizes of industrial and commercial leadership will fall to the nation which organizes its scientific forces most effectively." We need in this institution a more hearty recognition of the importance of research in its reaction upon the individual, of which I have not taken time to speak, in filling a place in the life of the university, and in serving the needs of the nation. If the subject can be estimated at its true value, rather than as an incidental and negligible matter, then time for some work in research for many, if not for all, teachers who may desire it will be forthcoming, even under the most adverse circumstances. One person in answering the question whether investigations are conducted during or outside of school hours says "both, when I can find time which I can not employ better. 'Le temps le mieux employé est celui qu'on perd.'" With a generally accepted high ideal of the value of research that could well be the test for every piece of scientific investigation. It would duly dignify and evaluate the work.

Whether time is to be given to pure or to applied research can best be left to individual choice. One reply reads: "Interested in commercial problems. Do not have much of the scientific spirit of investigation for the pure joy of knowing and of adding to the store of knowledge of the world." But "the pure joy of knowing," the pleasure of accomplishment irrespective of monetary or professional gain, should be the basic incentive for every piece of research, pure or applied. "We are living in the Garden of the Gods, but we are still eating grass," as one writer high in industrial circles visualizes the situation.

I shall venture to close my remarks with the words of Professor Ogden, of Cornell University, speaking recently at the installation of new members into this society on the subject of the purpose of research. I shall, however, take the liberty to reverse the accent placed upon the two forms, pure and applied, as better conveying the general trend of opin-

ion. "May I then express the hope," says Professor Ogden, "that among you," please consider that members of the Purdue Chapter are now intended, "there may be some who will find the subjects for their future experimental work, not only in modern practical applications, in attempted solutions of the many insistent problems of labor, industry and of education, but in abstract research, without thought of reward, carried on in the sole interest of science, that the existence of the university may be more fully justified and the purpose of the Society of Sigma Xi the better realized."

J. C. ARTHUR

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#### RAPHAEL BLANCHARD (1858-1919)

ON February 8, 1919, Professor Raphael Blanchard, of the Paris Medical Faculty, the most eminent medical zoologist and medical historian of modern France, died suddenly of heart failure, at the comparatively early age of sixty-one.

Professor Blanchard was born in the little Tourainian village of Ste. Christophe, on February 28, 1857. He was a great-grand-nephew of the famous ballonist Jean Pierre Blanchard, inventor of the parachute, and son of René Blanchard, a dramatic poet, who dying young, left behind him at least one *chef-d'œuvre* of the French stage, the little play of "Pierre Guiffort." Literary and poetic talent was a proper inheritance for the poet's son, who became one of the most distinguished of medical scholars in recent times. A taste for natural science drew young Blanchard to Paris in 1875, where he became attached, a year later, to the histological laboratory of Ch. Robin and Georges Pouchet at the École des Hautes Études. The next two years were spent in Germany, where he studied embryology at Vienna and Leipzig and comparative anatomy at Bonn. Upon his return, he served for a long period as préparateur for the physiologist Paul Bert, at the Sorbonne, and took his medical degree in 1880, with a graduating thesis on anesthesia

by nitrous oxide. At the age of twenty-six (1883), he obtained by concours, a professorship in the Paris Medical Faculty. In the meantime, he had published (1883) a little book on the German universities, which was destined to become well known among French educators. Blanchard's scientific career was deeply influenced by his German training, from which he probably acquired his taste for erudition and thoroughness in research. Up to the present war, he was a prominent link between French and German science.

In 1883, in collaboration with Paul Bert, he published a text-book on zoology. In the same year he began his monumental treatise on medical zoology (1885-90), which immediately established itself as the authoritative work on this subject. While the thematic material is mainly parasitology, this work is unquestionably the most comprehensive ever written on the different animals injurious to man. Its geographical and historical details give it a unique place among medical books; the bibliographies attest the wide learning and erudition of the author. With the publication of this work, Blanchard's reputation was established. In 1889, with Milne Edwards, he organized the first international congress of zoology.<sup>1</sup> In 1894, he was admitted to the portals of the Academy of Medicine, an unusual honor for a man of thirty-seven. In 1897, he succeeded Professor Baillon in the chair of medical zoology in the Paris Faculty, and, in 1907, at his request, this chair became specialized as the chair of parasitology. Blanchard made innumerable contributions to parasitology, principally at the Société Zoologique de France, of which he was one of the founders (1876), and for twenty years secretary; and later in the *Archives de Parasitologie*, the most important literary organ of this science, which he founded in 1898 and of which he remained editor until his death. This periodical is everywhere informed by the erudite genius of its editor. To it Blanchard contributed most of his original researches, his many biographies of great parasitologists,

<sup>1</sup> Blanchard was present at the meeting of the Congress in Boston, Mass., August 21, 1907.